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(54) **A method of making objects having an elastomeric outer wall and a synthetic foam core.**

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(73) Proprietor: **RECTICEL**
De Broquevillelaan 12
B-1150 Sint-Pieters-Woluwe (BE)

(72) Inventor: **Debaes, Bernard**
De Streep 4
B-8340 Damme (BE)
Inventor: **De Winter, Hugo**
Peter Benoîtlaan 31
B-9219 Gentbrugge (BE)
Inventor: **Nicolaus, Frank**
Bijlokeweg 75
B-9120 Destelbergen (BE)

(74) Representative: **Callewaert, Jean et al**
GEVERS Patents,
rue de Livourne 7,
Boîte Postale 1
B-1050 Bruxelles (BE)

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Description

The invention relates to a method of making in a mould cavity objects having an outer wall from a micro-cellular or non-cellular elastomer and a core consisting at least partly of a synthetic foam, according to the preamble of claim 1.

Such objects can for example be made by applying the know, classic polyurethane integral foam techniques.

However, these integral foam techniques involve, at least for certain applications, important drawbacks for instance, a relatively high foam density is required for obtaining an object with a solid skin formation which meets for example the rigid specifications applicable in the automobile industry with respect to physical properties and optical aspect of certain parts, such as for example the steering wheel, the head and arm rests, the dashboard, etc...

As a result of this high foam density, objects with a relatively high hardness are obtained. Moreover, in these classic techniques such a skin formation requires the use of chlorofluorohydrocarbons as a blowing agent.

In document US-A-4 251 476 a method of making ornamental vehicle wheels is described, consisting of spraying a thin layer of a film forming elastomer comprised in a volatile solvent on the inner wall of a mould, closing then the latter and injecting thereupon a polyurethane reaction mixture into the thus formed mould cavity.

Due to the fact that in this way a very thin film, having a thickness in the range of microns is thus formed, and in order to obtain a commercially marketable product, care has to be taken that the reaction mixture injected in the mould forms a sufficient ly strong and dense skin against this film since the latter shows as such only a small mechanical resistance. Consequently, when for example a gas bubble has been formed, in the cured reaction mixture against this film, then said film is usually never durable enough for covering this gas bubble. This involves that generally also in this method polyurethane integral foam techniques are used, consequently also with the drawbacks related hereto, as it has been mentioned hereabove.

The tendency in the automobile industry is to develop parts having a minimum weight whereby the total weight of the vehicles can be reduced resulting in a smaller energy consumption.

Consequently, the automobile industry aims at developing moulded pieces with a relatively low density, lower than 700 g/dm^3 and a smaller hardness, for example with a shore A smaller than 50, the latter especially for a so-called "soft touch".

This tendency is also followed by the furniture industry in the development of the sitting furniture for example.

Further, the use of chlorofluorohydrocarbons as a blowing agent in the manufacture of synthetic foam is nowadays kept away more and more since it has been accepted that they are the cause of the ozone layer decomposition in the stratosphere and that they would at the same time make increase the greenhouse effect on earth.

In order to avoid these different drawbacks of the integral skin techniques, the present invention relates to a method as defined in the preamble of claim 1 wherein said elastomer is first applied onto at least one mould part and a reaction mixture for obtaining the synthetic foam is injected, in a second step, in the mould cavity after having closed the mould.

Such a method is disclosed in Patent Abstracts of Japan, vol. 7, n° 215 (M-244) [1360] p. 144 M 244 (JP-A-58 110 225 Kasai Kogyo K.K.). In this known method use is made of a two part mould. Just as in US-A-4 251 476 the elastomer layer is only applied onto one mould part so that it is not required to join two elastomer layers applied to different opposing mould parts. A problem in this respect consists, indeed, in achieving a sufficiently strong joint between such two elastomer layers.

In order to achieve such a strong joint, the method according to the present invention is characterized by the features of claim 1. More particularly, the elastomer layer is also applied onto contacting sides of at least one of the mould parts so that this elastomer layer is pressed away at least into the direction of the mould cavity upon closing said mould so as to form a reinforcement on the inner side of the dividing joint.

A technique which can be employed for applying the elastomer layer onto the mould parts is the spray technique disclosed in Belgian patent application No. 8700792 corresponding to EP-A-0 303 305.

According to an interesting variant of the method according to the invention, in said first step, at the moment the mould is in its open position, an elastomer layer of a determined colour is applied onto the mould surface of one of the mould parts by spraying and an elastomer layer of another determined colour is applied onto the mould surface of the other mould part also by spraying, after which the mould is closed substantially immediately before starting with the hereabove defined second step.

In a preferred embodiment of the invention, use is made of a water blown reaction mixture of aromatic isocyanate compounds and hydrogen active compounds such as polyols which are substantially free of chlorofluorohydrocarbons, for forming polyurethane foam in said space of the mould cavity.

In a prefered embodiment of the invention, an elastomer layer of light stable polyurethane is formed on the mould cavity surface.

Other particularities and advantages of the invention will appear from the following description of some particular embodiments of the invention; this description is only given as an example and does not limit the scope of the invention as is defined in the appended claims; the reference numerals used hereafter relate to the annexed figures.

Figure 1 is a schematic representation of the different steps of a first embodiment of the method according to the invention.

Figure 2 is another representation of the sucessive steps in a second embodiment of the method according to the invention.

Figure 3 is, on a somewhat larger scale, a schematic representation of a particular characteristic of a specific embodiment of the method according to the invention.

Figure 4 is a schematic, vertical cross-section of a particular embodiment of a mould before applying a method according to the invention.

In these figures, the same reference numerals relate to the same or analogous elements.

Generally, the invention relates to a method for making in a mould cavity objects having an outer wall from a micro-cellular or non-cellular elastomer and a core consisting at least partly of a synthetic foam. The chemical composition of the elastomer as well as of the synthetic foam can be very different. Moreover, the elastomer and the synthetic foam do not necessarily have to belong to the same group of synthetic materials.

In Figure 1, a first embodiment of the method according to the invention is schematically shown.

In a preparatory step, the mould surface 1 of the two parts 2 and 3 the used mould 4 consists of, is covered with a mould release agent by means of a spray gun 5 in order to allow the formed pieces to be easily demoulded. In some cases, the mould release agent has also an important influence on the gleam of the formed piece and consists for example of a mixture of silicones, wax and solvent. This preparation step is thus executed, with the mould in its open position.

Then, a liquid reaction mixture consisting of several components, however substantially without solvent or with a restricted solvent amount for example in the range of 5%, in sprayed by means of a spray gun 6 on the mould surface 1 of both mould parts 2 and 3 in order to form an elastomer layer 7, the thickness of which is at least of 0.3 mm and at the most of 5 mm and is preferably between 1 and 2 mm. This can be done according to the technique described in Belgian patent application n° 8700792 of the same applicant. Afterwards, the mould 4 is closed by putting the two mould parts 2 and 3 against each other.

In a second step, before the elastomer is completely cured, i.e. when it is still somewhat sticky, a second reaction mixture for obtaining a synthetic foam is injected into the mould cavity space 8 defined by the formed elastomer layer 7.

Finally, in a third step, after the synthetic foam 9 is completely cured and forms a whole with the elastomer layer 7, the so obtained object is demoulded.

One of the main reasons to restrict the content of solvent, is thus to be able to form by spraying a sufficiently thick layer 7, because if, as in the known processes the reaction mixture is sprayed in presence of a relatively high content of solvent, f.i. about 20 %, then generally only a very thin layer, of some microns can be obtained.

In some cases, an insert 10, such as for example a metal frame, a wooden piece, a synthetic or a textile fabric, is placed in said space 8 of the mould cavity before injecting the synthetic foam in the latter.

Injecting the reaction mixture for obtaining a synthetic foam 9 is also done by means of à spray gun 11, the nozzle 12 of which is connected to an opening 13 provided in the upper part 2 of the mould 4, which is in fact the mould cover.

Therefor, use can for example be made of the so-called "RIM" (reaction injection moulding) technique.

In Figure 2 is shown schematically a second embodiment of the method according to the invention wherein a somewhat complexer mould 4 is used. In this embodiment, the bottom part 3 shows for example an undercut 14 which requires, in order to allow the formed piece to be removed from the mould 4, that the part 3 consists of at least two separate halves 3a and 3b which can be pulled out of each other for demoulding, as it has been indicated by arrows 15 in Figure 2.

In this embodiment of the method according to the invention, the elastomer layer 7 can for example be applied at the moment the parts 3a and 3b are separated from each other. This offers among others the advantage that in this way, the complete mould surface 1 is everywhere easily accessible for the spray gun

6.

Moreover, it is also possible in this embodiment to spray the mould surface 1 of these two parts 3a and 3b with an elastomer layer 7a, 7b respectively, having a different colour. Consequently also objects with two or more colours can be made and the dividing line between both colours can be very clear and accurate. This is mainly dependent on the precision of the mould construction itself.

Once the two halves 3a and 3b are disposed against each other, after the elastomer layer 7 has been sprayed, the other treatments are analogous to the ones in the previous embodiment, as it has been shown in Figure 1. An insert 10 can possibly be placed in the space 8 of the mould cavity before putting the halves 3a and 3b against each other, for example if this insert projects into the undercut 14, as it has been shown in Figure 2.

In an advantageous embodiment of the invention, an elastomer layer 7 consisting of a light stable polyurethane is formed.

This elastomer layer, obtained by putting several reaction components together, can be applied according to the so-called "airless" more component system without solvents.

The time period between the moment this elastomer layer is applied and the moment the synthetic foam is sprayed into the space 8 defined by this layer can be very important. Indeed care has to be taken that, on the one hand, the elastomer layer 7 is still sticky enough to assure a good adhesion between the synthetic foam and this layer and that, on the other hand, the elastomer layer has already a sufficient stability in order to avoid a destructive reaction between this layer and the synthetic foam. This time difference can be very diverse and is of course dependent on the nature of the elastomer as well as of the synthetic foam. However,when use is made of an elastomer and a foam based on polyurethane, it is generally comprised between 15 and 60 seconds.

It can also be very important to use a heated mould, for polyurethane preferably upto a temperature in the range of 60°.

The used synthetic foam's nature can also be very various since for example the appearance of the formed piece is only determined by the elastomer layer 7. In an advantageous way, use is made of a water blown reaction mixture of aromatic isocyanate compounds and hydrogen active compounds, such as polyols, which are substantially free of chlorofluorohydrocarbons, for forming a polyurethane foam in the space 8 of the mould cavity.

The synthetic foam's density can be controlled completely independent on the elastomer layer 7, this in contrast to what is the case when the classic integral foam techniques are used, as it has been described hereabove.

Further, also the optical aspect of the core foam is of course not critical and, provided that the hardness is adapted according to the piece to be made, use can be made of the so-called aromatic polyurethane systems which are also not light stable.

Moreover, the core foam can be flexible, semi-rigid or rigid, also according to the nature of the formed piece.

In Figure 3 a preferred embodiment of the method according to the invention is shown more in detail.

An object of this particular embodiment is to make products having a substantially invisible dividing joint.

To this end use is made, according to the invention, of a mould 4 comprising at least two mutually movable mould parts 2 and 3, which can be brought into an open and a closed position and of which the sides 7' of their edges (parting surfaces) make substantially hermetically contact with each other in the closed position

When using such a mould, the elastomer layer 7 is aaplied, in the hereabove described first step, not only onto the surface defining the mould cavity 8 of the mould 4 but also on the sides 7' as it appears clearly from Figure 3. Immediately after applying the reaction mixture for forming the elastomer layer, i.e. at the moment the latter is still liquid, the mould is closed under pressure so that the elastomer layer's part, located on these sides 7', is nearly completely pressed away, at least partly towards the mould cavity so as to form an internal, annular thickening 16, and preferably also towards the opposite side of the sides 7', outside the mould, as it appears also clearly from Figure 3 wherein the excess elastomer pressed outwards is indicated by reference numeral 17. In each cycle the latter is removed as a waste. In this way, a substantially invisible dividing joint is obtained on the outer side of the elastomer layer, near the place where the sides 7' of both mould parts 2 and 3 are in contact with each other. Moreover, the thickening 16 on the inner side of the dividing joint forms a useful reinforcement.

In an advantageous way, the sides 7' are preferably flat, whereas at least the side 7' of one of the mould parts 2 or 3 has a width of at least 0.5 mm and preferably from 2 to 10 mm, dependent on the shape and the specifications of the object to be made and on the nature of the used reaction mixture for forming

the elastomer layer 7. However, it has usually to be preferred that the sides 7' of both mould parts 2 and 3 have a limited width in order to avoid that the pressed away polyurethane, present at the outer side of the mould, would prevent further material to be pressed away between the sides 7'.

Finally, in Figure 4 is shown a particular embodiment of a mould for making according to the method of the invention objects comprising a central hole.

In order that, when pushing the two mould parts 2 and 3 on to each other, the part of the still liquid elastomer layer, situated on the sides 7', could be pressed away in a controlled manner into the in this case annular mould cavity as well as outside the latter and this also at the inner side of the mould, at least one of the mould parts 2 or 3, but preferably both of them, shows a central recess 18, which can receive the excess elastomer pressed outwards at the inner side of the mould parts' inner edge. The depth of this recess is of course somewhat dependent on the mould's nature and the elastomer amount applied already onto this mould part. A depth of about 10 mm will usually be appropriate.

In order to illustrate the method according to the invention, two particular examples of the method according to the invention and especially of the chemical formulations of both the elastomer layer and the synthetic foam which is appropriate for being injected in the space 8 of the mould cavity, are given hereafter.

Example 1

An elastomer layer has been formed on the inner surface of a mould consisting of two parts, which mould can be closed by a cover as it has been schematically shown in Figure 2, after this inner surface as well as the inner side of the cover has been covered with a release agent on the basis of silicones, wax and solvent. This elastomer layer has been obtained by spraying a polyol-cyanate reaction mixture at a flow rate of 25 g/sec, the polyol component pressure being 150 bars and the one of isocyanate component being 100 bars.

1. Characteristics of the polyol (first component)

Formulation in parts by weight	
Polyether-triol which is obtained by adding propylene oxide and ethylene oxide to glycerin as an initiator (OH index : 35 ; primary OH radical content : 80 %)	100
Ethylene glycol :	5
N'N -dimethylburtanediamine :	5
Lead octoate (33 % lead metal)	0.7
Colour paste :	5
	115.7

Properties	
Viscosity at 25 • C in MPa.s :	1170
Viscosity at 45 • C in MPa.s :	300
Viscosity at 65 • C in MPa.s :	150
Density (21 • C)	1.02

2. Characteristics of the isocyanate (second component)

Formulation in parts by weight	
Quasi-prepolymer (100 parts isophoronediisocyanate + 13.28 parts dipropylene glycol - final content of NCO groups : 26 %) : dimethylstanodineodecanoate	67.1 1 68.1

Properties	
Viscosity at 25° in MPa.s :	1450
Viscosity at 45° in MPa.s :	350
Viscosity at 65° in MPa.s :	50
Density (21°)	1.07

$$\text{Ratio : } \frac{\text{polyol component}}{\text{isocyanate component}} = \frac{115.7}{68.1} = 1.7$$

As soon as this elastomer has been applied onto the inner surface and the dividing joint of the mould, the latter has been closed and a reaction mixture for forming a semi-rigid polyurethane foam has been sprayed, after about 25 to 25 seconds, via an opening provided in the mould cover, into the closed space of the mould. This reaction mixture corresponded to the next formulation :

a) Polyol component

- 100 parts polyether-polyol cross-linker with a hydroxyl index of 1010 known under the trademark "U2311" of BP chemicals.
- 4 parts water
- 0.5 parts 2-methylimidazole
- 0.2 parts trimethylaminoethylethanolamine, known under the trademark "Dabco T" of "Air Products"
- 1.0 parts polydimethylsiloxane -polyether copolymer, known under the trademark "RS091" of BP Chemicals;
- 2.0 parts of a polyether polyol cell-opener, known under the trademark "PU3170" of Bayer.

b) Isocyanate component

67.74 parts of a methyldiisocyanate prepolymer (MDI) having a functionality of 2.49 and a NCO-number of 30.6, known under the trademark"ISO VM 50" of ICI.
After about 6 minutes, at the moment this reaction mixture was completely cured, the thus formed object has been demoulded.

Example 2

In this example, the same mould as in example 1 has been used. The formed elastomer layer has been obtained by spraying a polyol-isocyanate reaction mixture at a flow rate of 10 g/sec, the pressure of the polyol component was also 150 bars and the one of the isocyanante component was 100 bars.

1. Characteristics of the polyol (first component)

Formulation (in parts by weight)	
Polyethertriol of the same type as in example 1 :	90
Dabco 33 Lv (triethylene diamine : 33 % in a solution of DPG) :	2.25
Butanediol :	7. 9
Colour paste :	5
	105.15

Properties	
Viscosity at 25 • in MPa.s	1060
Viscosity at 45 • in MPa.s	320
Density (21 • C) :	1.02

2. Characteristics of the isocyanate (second component)

Formulation	
isocyanate RMA 200 (Upjohn) :	43.5

Properties	
Viscosity at 25 • C in MPa.s :	620
Viscosity at 45 • C in MPa.s	126
Density (21 • C)	1.21

$$\text{Ratio : } \frac{\text{polyol component}}{\text{isocyanate component}} = \frac{105.15}{43.5} = 2.42$$

As soon as this elastomer has been applied onto the inner surface of the mould, the latter has been closed and a reaction mixture for forming a polyurethane has been sprayed, after about 15 to 20 seconds, via an opening provided in the mould cover, into the closed space of the mould.
This reaction mixture corresponded to the next formulation :

a) Polyol component

- 100 parts polyether-polyol cross-linker with hydroxyl index : 36, known under the trademark "PBA 6500" of ICI ;
- 2.75 parts water :
- 0.15 parts of an amine catalyst with retarding action, known under the trademark " X 8154" of "Air Products";
- 0.10 parts of a mixture of bis (2-dimethylaminoethyl) ether (70%) and dipropylene glycol (30%), known under the trademark "A 1" of "Union Carbide";
- 0.60 parts dimethylhexadecylamine, known under the trademark "DM16D" of "Air Products"
- 0.60 parts polydimethylsiloxane - polyether copolymer, known under the trademark "B4113" of "Goldschmidt";

- 2 parts polyether polyol cell-opener, known under the trademark "PU3170" of Bayer
- 0.1 parts dimethylaminopropylamine, known under the trademark "DMAPA" of "Air Products".

b) Isocyanate component

47 parts of methyldiisocyanate prepolymer (MDI) having a functionality of 2.28 and a NCO number of 25, known under the trade mark "VM 28" of ICI

After about seven minutes, at the moment this reaction mixture was completely cured, the thus formed piece has been demoulded.

The invention is of course in no way limited to the hereabove described embodiments and within the scope of the invention, several modification can be taken into consideration among others with respect to the nature of the used polymer, the synthetic foam and also of the technique of spraying the polymer layer and injecting the synthetic foam. In this way, it can be possible in some cases to use a not completely closed mould wherein the synthetic foam can foam substantially freely.

Further, the mould, can be very different, depending on the object to be made. The mould can for example consist of different, mutually hingingly connected parts which can be brought then by means of a hydraulic system into an open and a closed position.

Claims

1. A method of making in a mould cavity objects having an outer wall from a micro-cellular or non-cellular elastomer (7) and a core comprising a synthetic foam (9), wherein use is made of a mould (4) comprising at least two mutually movable mould parts (2, 3), which can be brought into an open and a closed position with respect to each other, and wherein :
   - in a first step, a layer (7) of said elastomer is applied onto at least one of said mould parts (2, 3) by spraying a first reaction mixture thereto ;
   - in a second step, before the elastomer is completely cured, the mould parts (2, 3) are brought into said closed position and a second reaction mixture for obtaining the synthetic foam (9) is injected into the closed mould (4) ; and
   - in a third step, after the synthetic foam (9) has been cured substantially completely and forms a whole with the elastomer layer (7), the obtained object is demoulded,

   characterized in that use is made of a mould (4), the parts (2, 3) of which have edges with sides (7') which are in contact with each other in said closed position, and in that, in said first step, a layer of said elastomer is applied onto both mould parts (2, 3) and also on said contacting sides (7') of at least one of said mould parts (2, 3), and, in said second step, at least a portion of said elastomer layer (7) located on said contacting side (7') is pressed away at least into the direction of said mould cavity (8) by closing the mould (4) while said elastomer is still substantially liquid thereby connecting the elastomer layer (7) in each of said mould parts (2, 3) to each other.

2. A method according to claim 1, characterized in that use is made of a mould (4) with mould parts (2) and (3), the sides (7') of which make substantially hermetically contact with each other in the closed position.

3. A method according to claim 2, characterized in that use is made of a mould (4) with mould parts (2) and (3), the sides (7') of which have such a width that when closing the mould, the still substantially liquid elastomer layer, located between the sides (7') is pressed away as well in the mould cavity as on the opposite side of these sides (7').

4. A method according to claim 2, characterized in that use is made of a mould (4) with mould parts (2) and (3), the sides (7') of which are substantially completely flat and have a width of at least 0.5 mm and preferably of 2 to 10 mm.

5. A method according to anyone of the claims 1 to 4, characterized in that, in said first step, at the moment the mould (4) is in its open position, an elastomer layer (7a) of a predetermined colour is applied onto the mould surface (1) of one of the mould parts (2) by spraying and an elastomer layer (7b) of another pre-determined colour is applied onto the mould surface (1) of the other mould part (3) also by spraying, after which the mould (4) is closed substantially immediately before injecting said second reaction mixture.

6. A method according to anyone of the claims 1 to 5, characterized in that an insert (10) is placed in the mould cavity before starting with said second step.

7. A method according to anyone of the claims 1 to 6, characterized in that use is made of a water blown reaction mixture of aromatic isocyanate compounds and hydrogen active compounds such as polyols, which are substantially free of chlorofluorhydrocarbons, for forming polyurethane foam in said space of the mould cavity.

8. A method according to anyone of the claims 1 to 7, characterized in that an elastomer layer (7) of two or more reaction components is formed by spraying these reaction components without solvents according to the so-called "airless" more component system.

9. A method according to anyone of the claims 1 to 8, characterized in that on the mould cavity surface, an elastomer layer (7) is formed of light stable polyurethane.

10. A method according to anyone of the claims 1 to 9, characterized in that after a reaction time of 15 to 60 seconds of the elastomer layer (7) on the mould surface (1), the synthetic foam (9) is injected in the concerned space (8) of the mould cavity.

11. A method according to anyone of the claims 1 to 10, characterized in that use is made of a mould (4) which is heated up, preferably to a temperature of about 60 °C.

Patentansprüche

1. Verfahren zur Herstellung von Gegenständen in einem Formholraum, welche eine äußere Schicht aus einem mikrozellulären oder nichtzellulären Elastomer (7) und einen Kern umfassend einen synthetischen Schaum aufweisen, bei dem man eine Form (4) verwendet, welche mindestens zwei wechselseitig bewegliche Formteile (2, 3) aufweist, die aufeinander bezogen jeweils in eine geöffnete bzw. geschlossene Position gebracht werden können, und bei dem man:
   - in einem ersten Schritt durch Aufsprühen eines ersten Reaktionsgemisches auf mindestens eines der Formteile (2, 3) das Elastomer aufbringt,
   - in einem zweiten Schritt vor dem vollständigen Aushärten des Elastomeren die Formteile in die geschlossene Position bringt und zum Erhalt des synthetischen Schaumes (9) ein zweites Reaktionsgemisch in die geschlossene Form (4) injiziert und
   - in einem dritten Schritt, nachdem der synthetische Schaum (9) im wesentlichen vollständig ausgehärtet ist und mit der Elastomerschicht (7) ein Ganzes bildet, den erhaltenen Gegenstand aus der Form entnimmt,

   wobei das Verfahren dadurch gekennzeichnet ist, daß
   eine Form (4) verwendet wird, deren Teile (2, 3) Ecken mit in der geschlossenen Position miteinander in Kontakt stehende Kanten (7') aufweisen, und daß in dem ersten Schritt auf beide Formteile (2, 3) und auch auf die Kanten (7') von wenigstens einer der Formecken (2, 3) eine Elastomerschicht aufgebracht wird und in dem zweiten Schritt mindestens ein Teil der sich auf den Kontaktstellen (7') befindenden Elastomerschicht (7) wenigstens in Richtung auf die Formhöhlung (8) durch Schließen der Form (4) weggedrückt wird, solange das Elastomer noch im wesentlichen flüssig ist, wodurch die Elastomerschichten (7) in beiden Formteilen (2, 3) miteinander verbunden werden.

2. Verfahren gemäß Anspruch 1, dadurch gekennzeichnet, daß man eine Form (4) mit Formteilen (2) und (3) verwendet deren Kanten (7') in der geschlossenen Position im wesentlichen hermetisch abschließen.

3. Verfahren gemäß Anspruch 2 dadurch gekennzeichnet, daß man eine Form (4) mit Formteilen (2) und (3) verwendet, deren Kanten (7') eine solche Breite haben, daß beim Schließen der Form die zwischen den Kanten (7') befindliche, im wesentlichen noch flüssige Elastomerschicht sowohl in den Formhohlraum hinein als auch zur entgegensgesetzten Seite der Kanten (7') weggedrückt wird.

4. Verfahren gemäß Anspruch 2, dadurch gekennzeichnet, daß man eine Form (4) mit Formteilen (2) und (3) verwendet, deren Kanten (7') im wesentlichen ganz flach sind und eine Breite von mindestens 0,5 mm und vorzugsweise von 2 bis 10 mm haben.

5. Verfahren gemäß einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß in dem ersten Schritt zu dem Zeitpunkt, in dem die Form in der geöffneten Position ist, eine Elastomerschicht (7a) mit einer vorherbestimmten Farbe durch Aufsprühen auf die Oberfläche (1) eines Formteils (2) und ebenfalls durch Sprühen eine Elastomerschicht (7b) in einer anderen vorherbestimmten Farbe auf die Oberfläche des anderen Formteils (3) aufgebracht wird, wonach die Form nahezu sofort, bevor das zweite Reaktionsgemisch injiziert wird, geschlossen wird.

6. Verfahren gemäß einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß man vor Beginn des zweiten Schrittes ein Einspritzteil in den Formhohlraum einbringt.

7. Verfahren gemäß einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß man zum Bilden eines Polyurthanschaumes im Hohlraum der Form ein wassergeschäumtes Reaktionsgemisch aus aromatischen Isocyanatverbindungen und Verbindungen mit aktivem Wasserstoff wie Polyolen verwendet, welche im wesentlichen frei von Fluorchlorkohlenwasserstoffen sind.

8. Verfahren gemäß einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß eine Elastomerschicht aus zwei oder mehr Reaktionspartnern gebildet wird, indem man diese Reaktionspartner ohne Lösungsmittel nach dem sogenannten "luftfreien" Mehrkomponentensystem aufsprüht.

9. Verfahren gemäß einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß auf der Oberfläche des Formhohlraums eine Elastomerschicht (7) aus einem lichtbeständigen Polyurethan gebildet wird.

10. Verfahren gemäß einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß man nach einer Reaktionszeit von 15 bis 60 Sekunden der Elastomerschicht (7) auf der Formoberfläche (1) den synthetischen Schaum (9) in den jeweiligen Innenraum (8) des Formhohlraums injiziert.

11. Verfahren gemäß einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, daß man eine Form (4) verwendet welche vorzugsweise auf eine Temperatur von etwa 60 °C erhitzt wird.

Revendications

1. Procédé de fabrication dans une cavité de moule d'objets comportant une paroi extérieure d'un élastomère microcellulaire ou non cellulaire (7) et un noyau comprenant une mousse synthétique (9), dans lequel utilisation est faite d'un moule (4) comprenant au moins deux pièces de moule mutuellement mobiles (2, 3), qui peuvent être amenées en une position ouverte et fermée l'une par rapport à l'autre, et dans lequel :
   - dans une première étape, une couche (7) dudit élastomère est appliquée sur au moins une des pièces de moule (2, 3) en y pulvérisant un premier mélange de réaction ;
   - dans une seconde étape, avant que l'élastomère ne soit complètement durci, les pièces de moule (2, 3) sont amenées dans la position fermée et un second mélange de réaction pour obtenir la mousse synthétique (9) est injecté dans le moule fermé (4) ; et
   - dans une troisième étape, après que la mousse synthétique (9) a été pratiquement complètement durcie et forme un tout avec la couche d'élastomère (7), l'objet obtenu est démoulé,

   caractérisé en ce que utilisation est faite d'un moule (4), dont les pièces (2, 3) ont des bords avec des côtés (7') qui sont en contact l'un avec l'autre dans ladite position fermée et en ce que, dans la première étape, une couche de cet élastomère est appliquée sur les deux pièces de moule (2, 3) et également sur les côtés de mise en contact (7') d'au moins une des pièces de moule (2, 3), et, dans la seconde étape, au moins une partie de la couche d'élastomère susdite, positionnée sur le côté de mise en contact (7') est enfoncée au moins dans la direction de la cavité de moule (8) en fermant le moule (4) pendant que l'élastomère est encore essentiellement liquide, en reliant ainsi la couche d'élastomère (7) dans chacune des pièces de moule (2, 3) l'une à l'autre.

2. Procédé suivant la revendication 1, caractérisé en ce que utilisation est faite d'un moule (4) avec des pièces de moule (2) et (3), dont les côtés (7') réalisent un contact essentiellement hermétique l'un avec l'autre dans la position fermée.

3. Procédé suivant la revendication 2, caractérisé en ce que utilisation est faite d'un moule (4) avec des pièces de moule (2) et (3), dont les côtés (7') ont une largeur telle que, lors de la fermeture du moule,

la couche d'élastomère encore essentiellement liquide, disposée entre les côtés (7') est enfoncée aussi bien dans la cavité de moule que sur la face opposée de ces côtés (7').

4. Procédé suivant la revendication 2, caractérisé en ce que utilisation est faite d'un moule (4) avec des pièces de moule (2) et (3), dont les côtés (7') sont essentiellement complètement plans et ont une largeur d'au moins 0,5 mm et avantageusement de 2 à 10 mm.

5. Procédé suivant l'une quelconque des revendications 1 à 4, caractérisé en ce que, dans la première étape, au moment où le moule (4) est dans sa position ouverte, une couche d'élastomère (7a) d'une couleur prédéterminée est appliquée sur la surface de moule (1) d'une des pièces de moule (2) par pulvérisation et une couche d'élastomère (7b) d'une autre couleur prédéterminée est appliquée sur la surface de moule (1) de l'autre pièce de moule (3) également par pulvérisation, après quoi le moule (4) est fermé presque immédiatement avant d'injecter le second mélange de réaction.

6. Procédé suivant l'une quelconque des revendications 1 à 5, caractérisé en ce qu'une pièce d'insertion (10) est placée dans la cavité de moule avant de commencer la seconde étape.

7. Procédé suivant l'une quelconque des revendications 1 à 6, caractérisé en ce que utilisation est faite d'un mélange de réaction soufflé à l'eau de composés d'isocyanate aromatiques et de composés actifs hydrogénés, tels que des polyols qui sont essentiellement exempts de chlorofluorohydrocarbones, pour former une mousse de polyuréthanne dans l'espace précité de la cavité de moule.

8. Procédé suivant l'une quelconque des revendications 1 à 7, caractérisé en ce qu'une couche d'élastomère (7) de deux ou plusieurs composants de réaction est formée par pulvérisation de ces composants de réaction sans solvants suivant le système à plusieurs composants dit "sans air".

9. Procédé suivant l'une quelconque des revendications 1 à 8, caractérisé en ce que sur la surface de cavité de moule, une couche d'élastomère (7) est formée de polyuréthanne stable à la lumière.

10. Procédé suivant l'une quelconque des revendications 1 à 9, caractérisé en ce qu'après un temps de réaction de 15 à 60 secondes de la couche d'élastomère (7) sur la surface de moule (1), la mousse synthétique (9) est injectée dans l'espace concerné (8) de la cavité de moule.

11. Procédé suivant l'une quelconque des revendications 1 à 10, caractérisé en ce que utilisation est faite d'un moule (4) qui est chauffé, avantageusement à une température d'environ 60 • C.

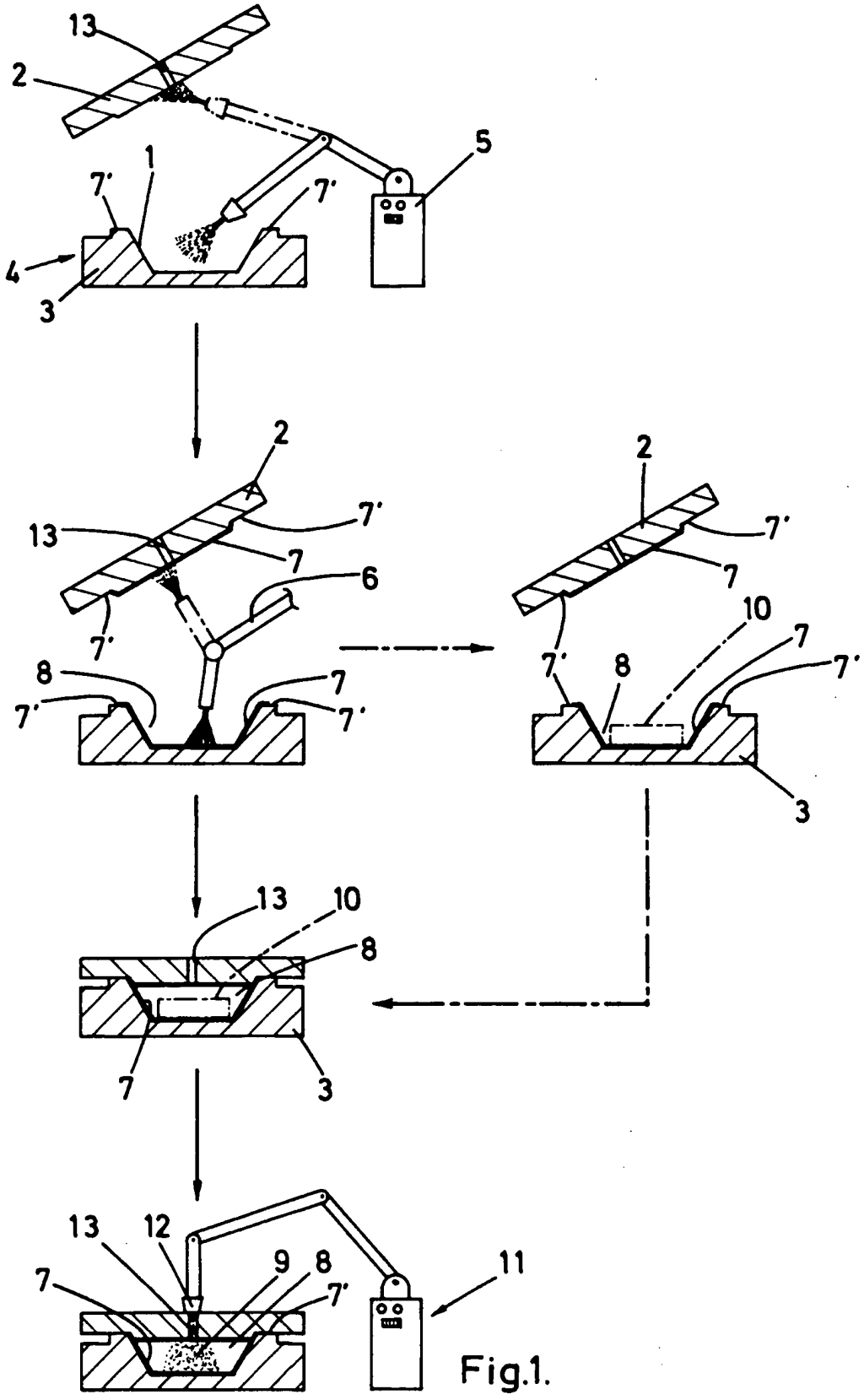

Fig.1.

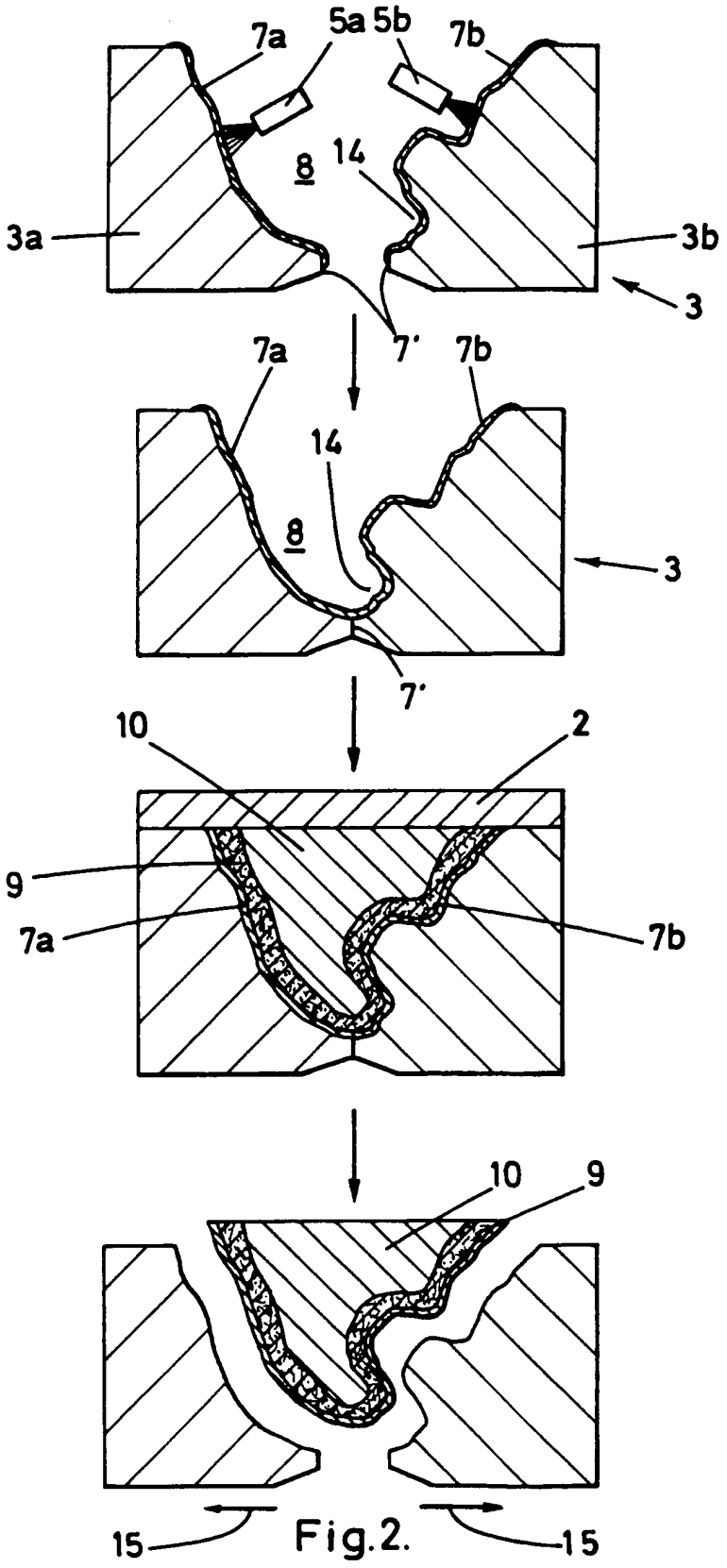

Fig.2.

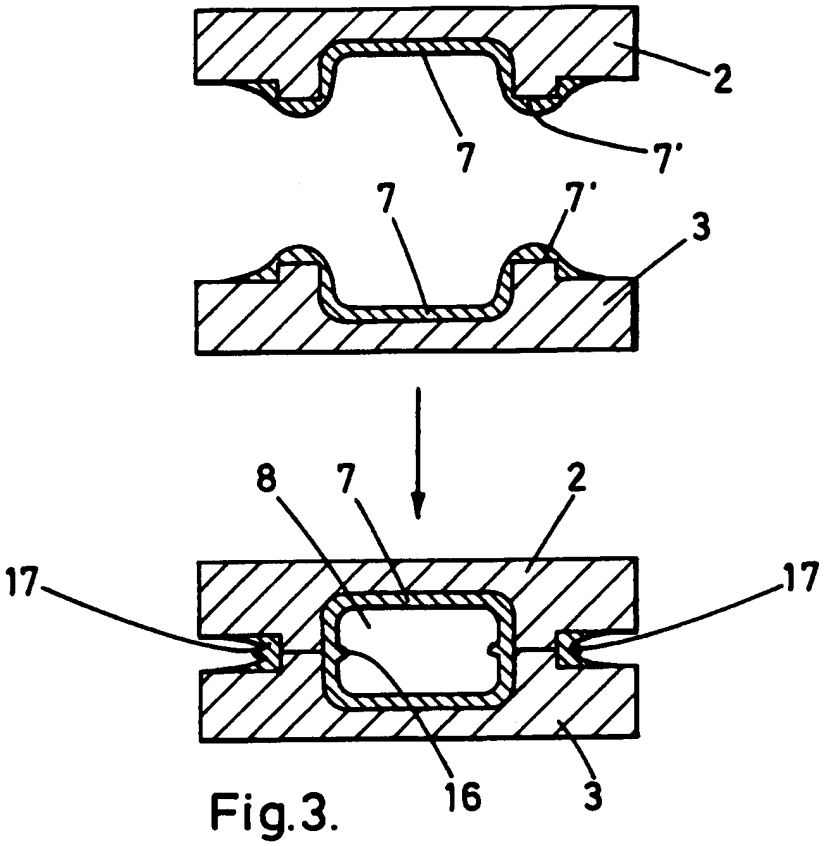

Fig.3.

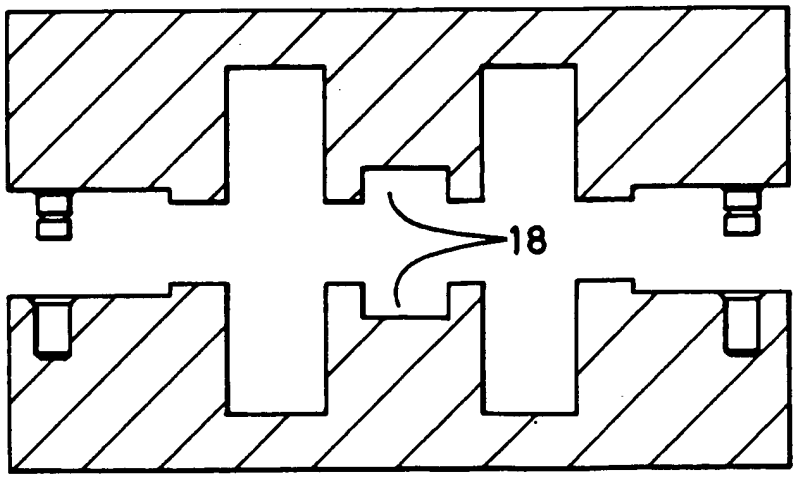

Fig.4.